



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-01

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 1/10/12

FINISH: 1/10/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	no recovery		Based on required connections Traffic-Rated Vault Dimensions based on other criteria
5	fill material		Bentonite Chips
	fill material, angular rock		
10	fine gravel, moist, brown, loose, 0.9 ppm		2-in. dia Sch 40 PVC; flush threaded 2-in. dia with flush-threaded bottom cap
	soft clay with 5% fine sand, moist, soft plastic, light brown - light gray, 0.5 ppm		
	soft clay with 5% fine sand, moist, plastic, light gray, 1.8 ppm		
	stiff, clay with 5% fine sand, moist, plastic, light gray, 6.4 ppm		
15	very fine sand with little clay, moist, loose, 7.2 ppm		
	saturated, fine sandy with some silt, 7.5 ppm		
	moist, sand, light black, loose, 95% sand, 3.8 ppm		2-inch dia.; Schedule 40; 0.010-inch slot size mill-slotted screen
20	light gray, clay, moist - stiff, 3.5 ppm		
	light gray, clay, moist, stiff, 1.2 ppm		10-20 Colorado Sand; 6 bgs
25	seen observed, saturated, water level at 27', semi-plastic, stiff, gray, clay, 15.7 ppm		
	light gray - brown, wet, stiff, clay, semi-plastic, 8.0 ppm		
30			
	End of Log		
35			



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-02

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

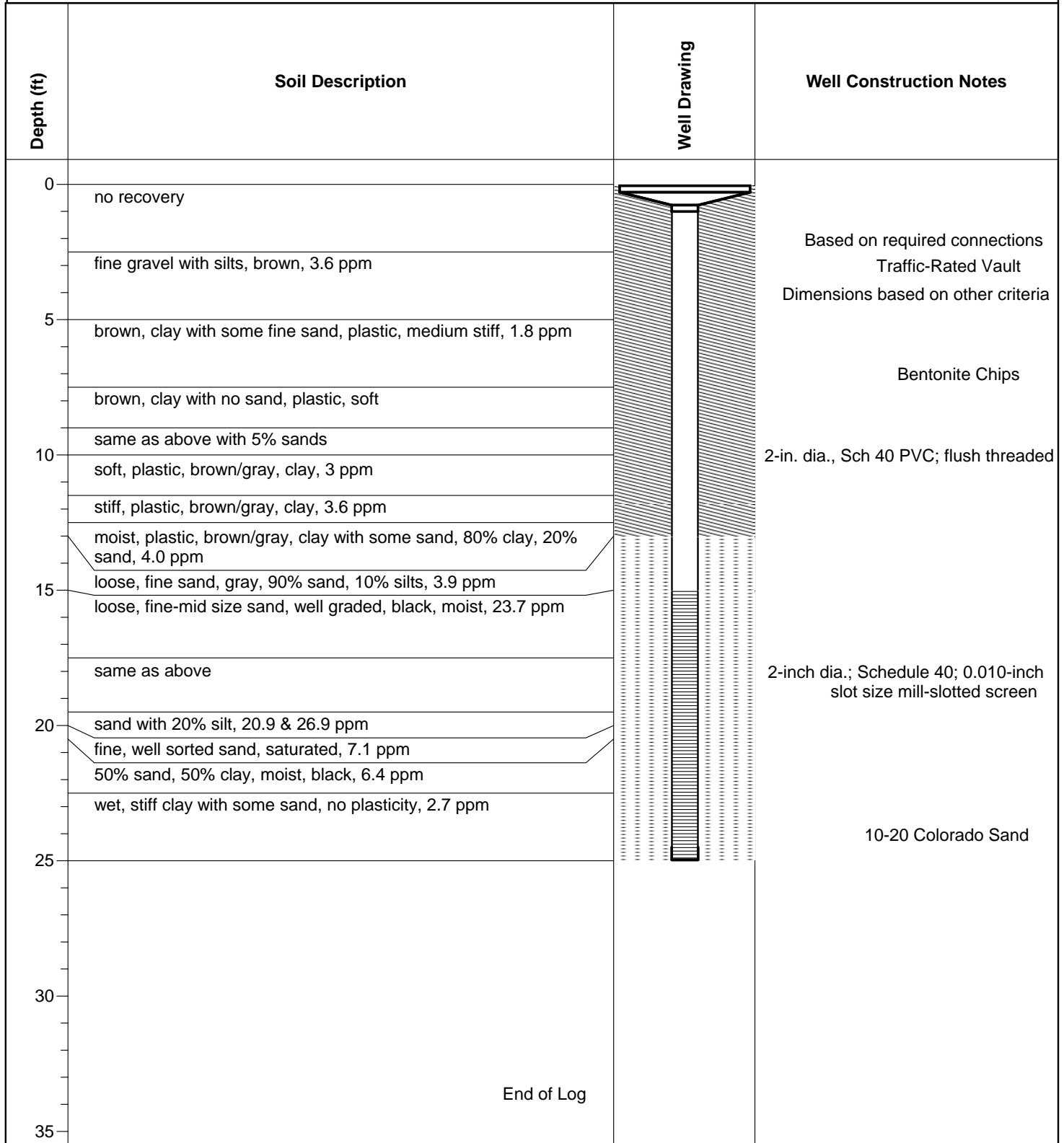
DRILLER:

WATER LEVELS:

START: 1/10/12

FINISH: 1/10/12

LOGGER: Maria F.





CH2MHILL

PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-03

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

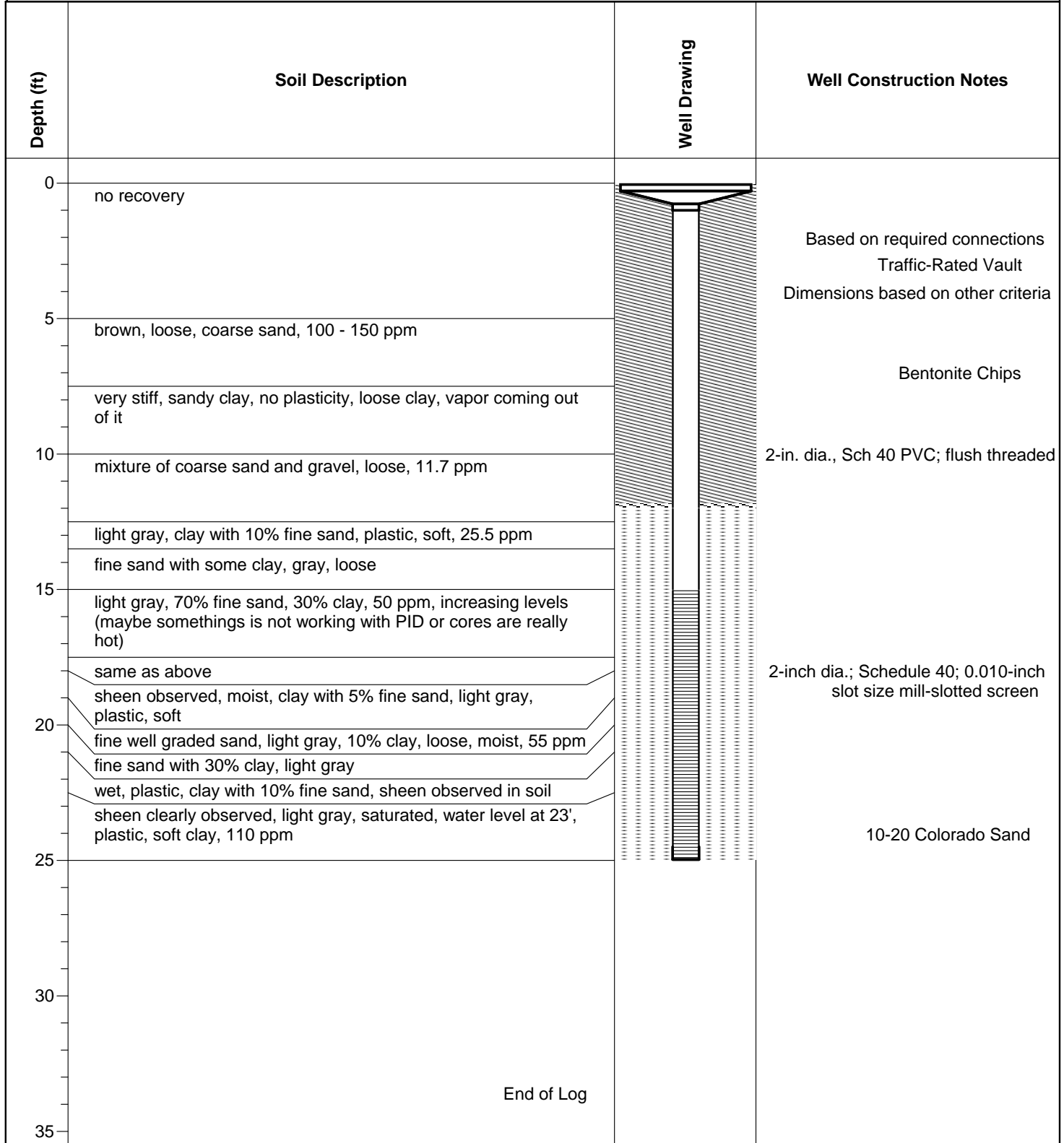
DRILLER:

WATER LEVELS:

START: 1/11/12

FINISH: 1/11/12

LOGGER: Maria F.





PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-04

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 1/11/12

FINISH: 1/11/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	mostly fill material, coarse grained, moist, 102 ppm		<p>Based on required connections Traffic-Rated Vault Dimensions based on other criteria</p> <p>Bentonite Chips</p> <p>2-in. dia. Sch 40 PVC; flush threaded</p> <p>2-inch dia.; Schedule 40; 0.010-inch slot size mill-slotted screen</p> <p>10-20 Colorado Sand</p>
	clay with fine to medium sand, plastic, wet, plastic brown, 5.7 ppm		
5	same as above, 0.7 ppm		
	80% clay, 20% fine sand, moist, plastic, 1.2 ppm		
10	brown, 90% clay, pockets of fine sand		
	light brown -gray, very stiff, clay, 4.6 ppm		
	wood debris, 180 ppm		
	very stiff, clay, no sand		
	clay with fine sand, 50% clay, 50% fine sand, gray, moist		
15	very stiff, gray, clay with some sand, wet, moist		
	light gray, moist, clay with fine sand, 60% clay, 40% fine sand, loose, stiff, 306 ppm		
	light gray, fine sand with clay, 60% fine sand, 40% clay, loose, 230 ppm		
20	light gray, fine sand, loose, wet, 70% fine sand, 30% clay, 250 ppm		
	saturated, light gray, clay		
	light gray, clay, saturated, water level at 24', sheen, plastic is brown, medium stiff, semi-plastic, 180 ppm		
25			
30			
35	End of Log		



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-05

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 3/6/12

FINISH: 3/6/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	fill material, rocks and gravel		<p>Based on required connections Traffic-Rated Vault Dimensions based on other criteria</p> <p>Bentonite Chips</p> <p>2-in. dia. Sch 40 PVC; flush threaded</p> <p>2-inch dia.; Schedule 40; 0.010-inch slot size mill-slotted screen</p> <p>10-20 Clorado Sand</p>
	red-brown, coarse sand, very loose, 180.3 ppm		
5	brown, loose, coarse sand with gravel		
	gray, loose, coarse sand with gravel, 637.5 ppm		
	gray, well graded sand, very loose, no silt, 9' = 190 ppm, 10' - 373 ppm		
10	gray, loose, well graded sand with some brown sand, 303 ppm		
15	gray, very loose, poorly graded sand with some fine gravel		
	gray, moist, loose, fine sand with some silt, 440 ppm		
20	moist, poorly graded sand, 340 ppm		
	gray, very dense fine sand		
	gray, very dense fine sand with 50% clay		
	gray, loose fine sand		
25	gray, moist, fine sand with clay		
	End of Log		
35			



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-06

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 3/6/12

FINISH: 3/6/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	fill material, gray-brown coarse sand		Based on required connections Traffic-Rated Vault Dimensions based on other criteria Bentonite Chips 2-in. dia. Sch 80 PVC; flushed threaded
	brown, well graded coarse sand		
	brown, well graded sand		
5	gray, moist, well graded fine sand, loose		
10	gray, well graded, moist, loose, fine sand with some clay at 12', sheen observed, 12' = 326 ppm, 15' = 323 ppm		
15	gray, extremely saturated, sheen observed, very loose, fine sand		
20	gray, wet, loose, fine sand, well graded, 106 ppm		
	transition to gray sand wth clay		2-inch dia.; Schedule 40; 0.010-inch slot size mill-slotted screen 10-20 Colorado Sand; 16 bags
	gray, wood debris, very stiff, clay with fine sand		
25			
30			
35	End of Log		



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-07

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 1/10/12

FINISH: 1/10/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	no recovery		Based on required connections Traffic-Rated Vault Dimensions based on other criteria
5	fill material, brown, gravel, 0.0 ppm		Bentonite Chips
	brown, clay with sand		
	brown, clay with sand, 0.0 ppm		
	brown, moist, clay, very plastic, no odor, 0.0 ppm		
10	brown to gray, moist, silt with sand, 70% silt, 30% very fine sand, loose		2-in. dia. Sch 40 PVC; flush threaded
	no recovery		2-inch dia.; Schedule 40; 0.010-inch slot size mill-slotted screen
	light brown-gray, moist, clay, very plastic, slight odor not detected with PLP		
15	light brown, clay with some fine sands, 60% clay, 40% sand, moist, loose, non-plastic		
	dark gray, mostly sand with some clay, 90% fine sand, moist, loose, material		
	dark gray, sand with some clay, moist, loose, 80% sand, 20% fine silt, 20.1 ppm		
20	light gray, clay, 15% fine sand, plastic, moist, 0.3 ppm		10-20 Colorado Sand
	light gray, clay, 15% fine sand, plastic, same as above, moist, 0.4 ppm, water level is around 25', decided to go 5' deeper and instead of using 10' screen, go with 15' screen		
25	light gray, very moist, saturated, silt with 15%, plastic, water level at 26', sheen observed, 2.2 ppm		
	very moist, saturated, silt with 10% fine sand, 2.3 ppm		
30			
35	End of Log		



PROJECT NUMBER: 434697.01.01

BORING NUMBER: PZ-08

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotosonic

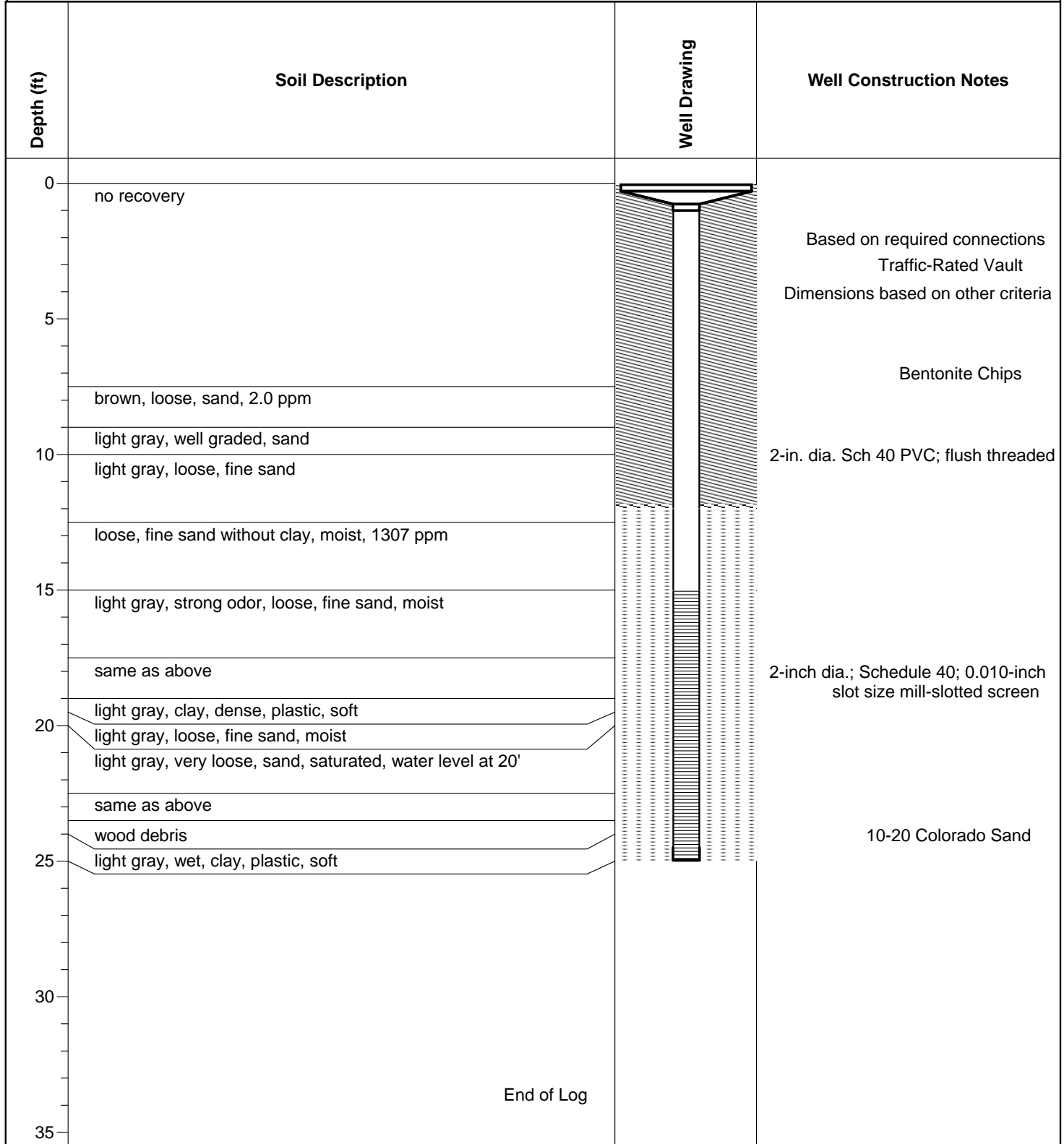
DRILLER:

WATER LEVELS:

START: 1/11/12

FINISH: 1/11/12

LOGGER: Maria F.





PROJECT NUMBER: 434697.01.01

BORING NUMBER: EW-01

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 1/12/12

FINISH: 1/12/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	light brown, moist, medium stiff plastic, 80% clay, 20% fine sand, 0.0 ppm		Based on required connections Traffic-Rated Vault Dimensions based on other criteria
	same as above, 0.0 ppm		Bentonite Chips
5	light brown/red clay with 20% fine sand, semi-plastic, medium stiff, 5 - 6' some red, 0.0 ppm		6-in. dia. Sch 80 PVC; flush threaded 6-in. dia.; 2-ft long Sch 80 PVC with flush-threaded bottom cap
	light gray clay, stiff, semi-plastic, 0.0 ppm		
10	loose fine sand, well graded with 10% silts		
	loose sand, well graded, light gray, 85.9 ppm		
	well graded fine sand, very loose, 12.5 - 13' = 157 ppm, 13 - 14' = 26.1 ppm, 14 - 15' = 26 ppm		
15	moist, loose fine sand, well graded, light gray, 16' = 117 ppm, 17' = 194 ppm		
	moist, fine sand, well graded, with 5% clay, loose, 140 ppm		6-inch dia.; Schedule 80; 0.040-inch slot size mill-slotted screen
	50% fine sand, 50% clay, wet, light gray, plastic		
20	sheen, clay, light gray, wet, 5% fine sand, plastic, soft, 80 ppm		
	same as above, wet		
	saturated, sheen observed		
	wet, light gray clay, plastic, semi-stiff		
25	light gray, wet clay, very stiff, plastic with drops of oil		10-20 Colorado Sand
	sandy clay, moist, light gray, oil droplets		
	sheen observed, sandy clay, non-plastic, stiff		
	light gray clay, 5% very fine sand		
	plastic, medium stiff		
	very soft plastic, wet, light gray clay		
30	stiff, plastic, light gray clay, sheen observed		Stainless steel centralizer; top and bottom of screen
	soft, plastic, wet clay		
	loose clay with 100% very fine sand, very stiff, non-plastic, sheen observed, droplets of oil can be seen down to 33'		
	End of Log		
35			



PROJECT NUMBER: 434697.01.01

BORING NUMBER: EW-02

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

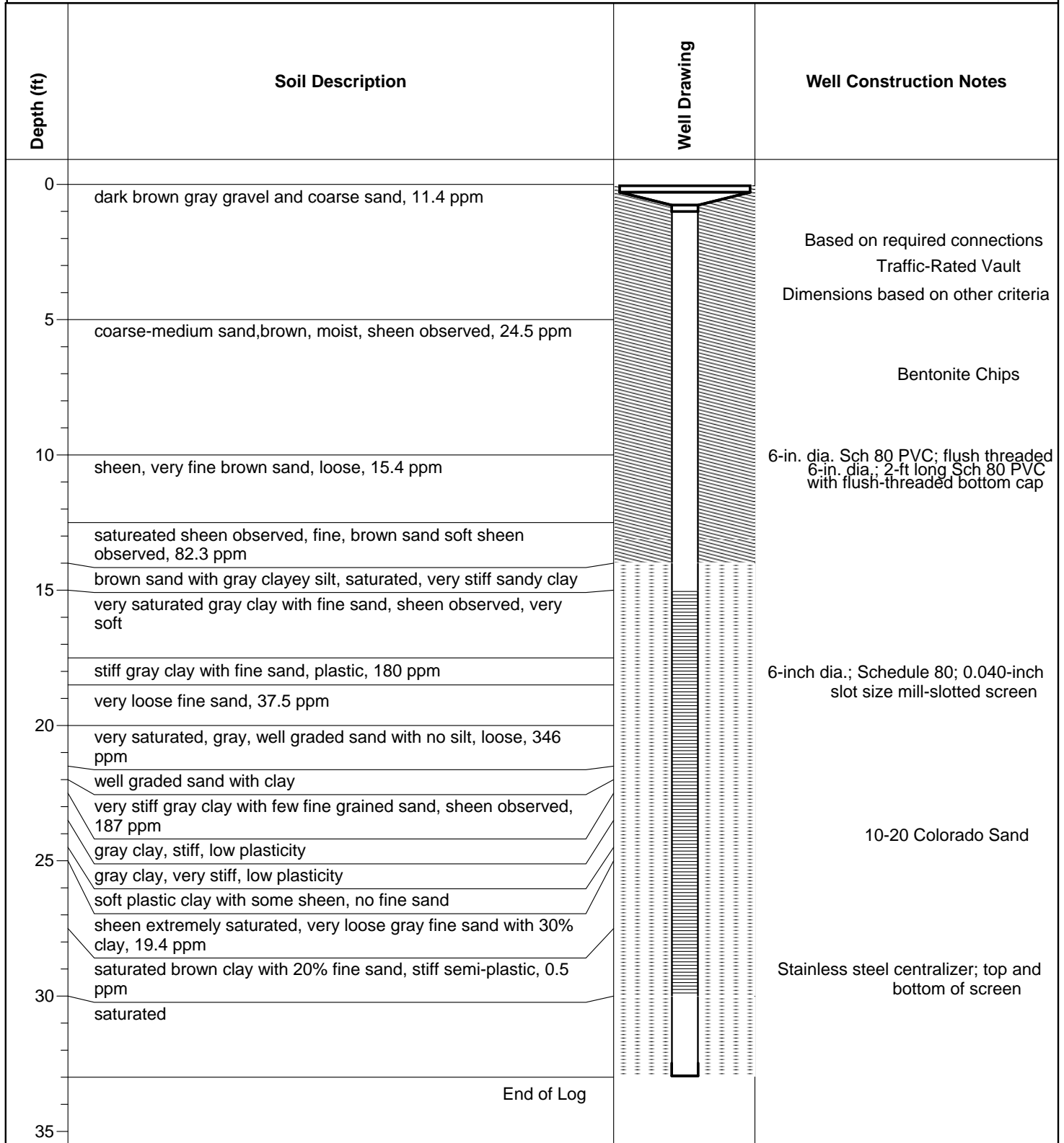
DRILLER:

WATER LEVELS:

START: 3/5/12

FINISH: 3/6/12

LOGGER: Maria F.





PROJECT NUMBER: 434697.01.01

BORING NUMBER: EW-03

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

DRILLER:

WATER LEVELS:

START: 3/5/12

FINISH: 3/6/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	no recovery		Based on required connections Traffic-Rated Vault Dimensions based on other criteria
	brown, coarse sand and gravel, 278 ppm		
5	brown fine sand, 281 ppm		Bentonite Chips
	abrupt change in color, brown to gray fine sand		
	gray well graded sand, loose, moist, 103.7 ppm		
10			
	No recovery, expecting recovery, but nothing was recovered		6-in. dia. Sch 80 PVC; flush threaded 6-in. dia.; 2-ft long Sch 80 PVC with flush-threaded bottom cap
15	loose, coarse sand, moist, gray, 15' - 909 ppm, 15.5' = 420 ppm		
	wet, loose, gray, well graded fine sand, 510 ppm		
20	saturated, loose, gray, well graded sand with clay, 314 ppm wet, gray sand, 11.3 ppm		
	sheen observed and wood debris throughout core, 35.4 ppm		6-inch dia.; Schedule 80; 0.040-inch slot size mill-slotted screen
	moist, gray, fine sand with 40% clay, dense sand		
25	medium dense sand, moist very saturated core		
	stiff clay with well graded fine sand		
30	soft gray clay with well graded very fine sand moist, very stiff clay, gray with 10% very fine sand		10-20 Colorado Sand Stainless steel centralizer; top and bottom of screen
	plastic, moist, stiff, gray clay		
	wet plastic, soft gray clay		
35	End of Log		



PROJECT NUMBER: 434697.01.01

BORING NUMBER: EW-04

Sheet: 1 of 1

Piezometer Completion Diagram

PROJECT: Kinder Morgan - Linton Terminal

LOCATION: 11400 NW St. Helens Road, Portland, OR

ELEVATION:

DRILLING CONTRACTOR: Major Drilling

DRILLING METHOD AND EQUIPMENT: Rotasonic

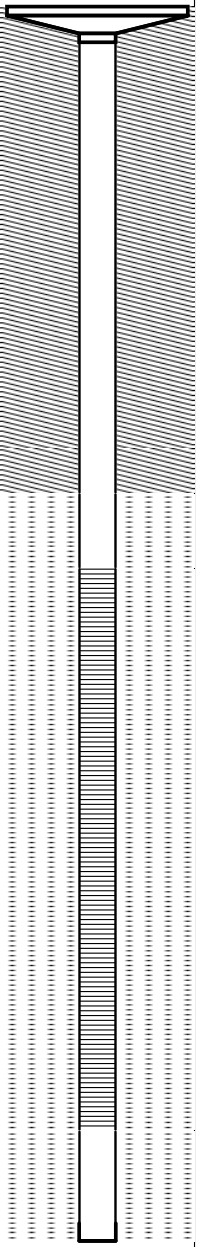
DRILLER:

WATER LEVELS:

START: 3/7/12

FINISH: 3/7/12

LOGGER: Maria F.

Depth (ft)	Soil Description	Well Drawing	Well Construction Notes
0	fill material, brown coarse gravel and cobbles, loose, moist		Based on required connections Traffic-Rated Vault Dimensions based on other criteria
5	well graded, brown, moist, medium well sorted sand		Bentonite Chips
10	brown, well graded medium sand, loose, 1.2 ppm		6-in. dia. Sch 80 PVC; flush threaded 6-in. dia.; 2-ft long Sch 80 PVC with flush-threaded bottom cap
15	moist, well graded medium sand, brown, loose with some clay at 19 - 20', 2.5 ppm		6-inch dia.; Schedule 80; 0.040-inch slot size mill-slotted screen
20	moist, well graded, brown, medium sand with some clay		10-20 Colorado Sand
	wet, well graded, brown, medium sand, loose		Stainless steel centralizer; top and bottom of screen
	saturated, brown, sandy clay, wood debris, medium stiff		
	saturated, brown, very soft, fine sand with clay		
25	very saturated, but very stiff clay with 10% very fine sand, brown		
	very saturated, soft, brown, clay with 40% fine sand		
30	very saturated fine sand with some clay		
	End of Log		
35			



PROJECT NUMBER:
475601.01.02

BORING NUMBER:
EW-5*

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Kinder Morgan Liquid Terminals Extraction Wells Installation.

*Note: Installed at location proposed as EW-6 in work plan.

LOCATION : Linnton Terminal; Portland, OR

DRILLING CONTRACTOR : Cascade Drilling LP

DRILLING EQUIPMENT AND METHOD : CME-85 Truck-Mounted Drill Rig, Hollow Stem Auger

WATER LEVELS : ---

START : 6/13/2013

END : 6/13/2013

LOGGER : R. Lucich

WATER LEVELS : ---		START : 6/13/2013		END : 6/13/2013		LOGGER : R. EGGH	
DEPTH BELOW SURFACE (feet)	SAMPLE INTERVAL (feet)		STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION		WELL CONSTRUCTION DIAGRAM	
	RECOVERY (%)	#TYPE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	CASING MATERIAL, SCREEN TYPE, SEAL TYPE, FILTER SAND TYPE		
					18" Flush Mount Vault	PID Reading (ppm):	
	0.0		Air Knife		Well Graded Gravel (GW) 0.0-0.5' - gray, (2.5Y 5/1), dry, loose, angular Well Graded Sand (SW) 0.5-22.0' - dark brown, (10YR 3/3), moist, loose, subrounded (0/95/5), moderate hydrocarbon odor.		
5	5.0					1.0' Top Depth of Seal Transition	
	6.5	100	SPT-1	3-5-4 (9)		2.0' Top Depth of Seal	
						Bentonite Chips	HS = 15.1 ppm
						6.0' Top Depth of Filter Pack	
10	10.0	100	SPT-2	2-2-2 (4)	11' - Grades to dark grey (10YR 4/1).	7.0' Top Depth of Screen	BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0 HS = 302 ppm
	11.5						
							BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0 HS = 26.2 ppm
15	15.0	100	SPT-3	3-4-3 (7)	15.5-16.0' - 1/4" to 1/2" thick silty sand layers. 16.5-20' - Becomes wet.		
	16.5						BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0 HS = 125 ppm
20	20.0	100	SPT-4	5-11-12 (23)	20' - Becomes medium dense.		
	21.5						
	23.0	100	SPT-5	5-3-3 (6)	Silt (SM) 22.0-27.5' - gray, (10YR 5/1), moist, medium soft, low plasticity (0/5/95).	22.0' Bottom Depth of Screen	BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0
25	24.5	100	SPT-6	3-3-4 (7)			HS = 3.9 ppm
	26.0	100	SPT-7	3-3-5 (8)	26' - Grades to light olive brown (2.5Y 5/3).	Bentonite Chips	
	27.5	100	SPT-8	3-3-5 (8)	End Drilling on 6/13/2013 Total Borehole Depth: 27.5 ft bgs	27.0' Bottom Depth of Well 27.5' Bottom Depth of Filter Pack and Borehole	
						12"	
30					ABBREVIATIONS ' = Feet BZ = Breathing Zone HS = Head Space Sample VOCs = Volatile Organic Compounds	Well Casing and Screen Materials Casing Material: Sch 80 PVC Casing Diameter: 4-in Seal Transition Type: Pea Gravel Seal Type: 3/8" Bentonite Chips Pack Type: 10 X 20 Colorado Sand Screen Length: 15 ft Screen Type: Sch 80 PVC, 0.020" Milled Slots	
35							



PROJECT NUMBER:
475601.01.02

BORING NUMBER:
EW-Test*

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Kinder Morgan Liquid Terminals Extraction Wells Installation.

*Note: Installed at location proposed as EW-5 in work plan.

LOCATION : Linnton Terminal; Portland, OR

DRILLING CONTRACTOR : Cascade Drilling LP

DRILLING EQUIPMENT AND METHOD : CME-85 Truck-Mounted Drill Rig, Hollow Stem Auger

WATER LEVELS : ---

START : 6/11/2013

END : 6/12/2013

LOGGER : R. Lucich

WATER LEVELS : ---		START : 6/11/2013		END : 6/12/2013		LOGGER : R. EGGERT	
DEPTH BELOW SURFACE (feet)	SAMPLE INTERVAL (feet)		STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS	
	RECOVERY (%)	#TYPE	6"-6"-6" (N)	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION PID Reading (ppm):			
5	0.0		Air Knife		Well Graded Gravel (GW) 0.0-0.5' - gray, (2.5Y 5/1), dry, loose, angular Well Graded Sand (SW) 0.5-3.0' - dark brown, (10YR 3/3), moist, loose, fine to coarse grained, subrounded (0/90/10). Silty Sand (SW) 3.0-5.0' - dark brown, (10YR 3/3), moist, loose, fine to medium grained, subrounded (0/70/30). 4.5' - Becomes dark gray (10YR 4/1).	BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0	
	5.0						
10	6.5	100	SPT-1	2-2-3 (5)	Well Graded Sand (SW) 5.0-19.0' - dark gray, (10YR 4/1), moist, loose, fine to coarse grained (0/100/0), subrounded, moderate hydrocarbon odor.	HS = 36.7 ppm BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0 HS = 123 ppm	
	8.5	100	SPT-2	3-6-5 (11)			
	10.0						
15	13.5	100	SPT-3	4-3-6 (9)	15.0-18.5' - Becomes wet.	HS = 63.7 BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0	
	15.0						
20	18.5	100	SPT-4	2-2-4 (6)	Silt (ML) 19.0-23.0' - gray, (10YR 5/1), moist, soft to stiff, low plasticity (0/0/100), moderate odor, moderate dark stain.	HS = 61.6 ppm	
	20.0	100	SPT-5	1-3-6 (9)			
	21.5	100	SPT-6	3-6-7 (13)			
	23.0						
25					End Drilling on 6/12/2013 Total Borehole Depth: 23.0 ft bgs		
30					ABBREVIATIONS ' = Feet BZ = Breathing Zone HS = Head Space Sample VOCs = Volatile Organic Compounds		
35							



PROJECT NUMBER:
475601.01.02

BORING NUMBER:
PZ-9

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Kinder Morgan Liquid Terminals Extraction Wells Installation

LOCATION : Linnton Terminal; Portland, OR

DRILLING CONTRACTOR : Cascade Drilling LP

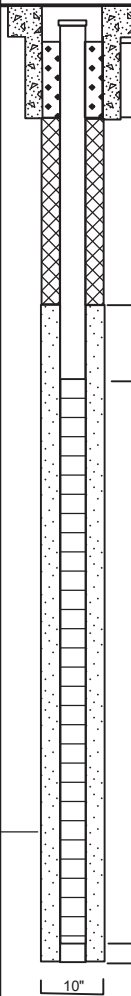
DRILLING EQUIPMENT AND METHOD : CME-85 Truck-Mounted Drill Rig, Hollow Stem Auger

WATER LEVELS : ---

START : 6/11/2013

END : 6/12/2013

LOGGER : R. Lucich

WATER LEVEL:		DATE: 6/12/2013		END: 6/12/2013		LOGGERS: R. EGGERT	
DEPTH BELOW SURFACE (feet)	SAMPLE INTERVAL (feet)		STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION	WELL CONSTRUCTION DIAGRAM	
	RECOVERY (%)	#TYPE	6"-6"-6" (N)	CASING MATERIAL, SCREEN TYPE, SEAL TYPE, FILTER SAND TYPE		10" Flush Mount Vault	PID Reading (ppm):
	0.0		Air Knife		Well Graded Gravel (GW) 0.0-0.5' - gray, (2.5Y 5/1), dry, loose, angular		
					Well Graded Sand (SW) 0.5-8.75' - dark brown, (10YR 3/3), moist, loose, fine to coarse grained, subangular (0/100/0).	1.0' Top Depth of Seal Transition	
5	5.0					3.0' Top Depth of Seal	BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0 HS = 0.3 ppm
	6.5	100	SPT-1				
						8.0' Top Depth of Filter Pack	
10	10.0				Well Graded Sand (SW) 8.75-18.75' - gray, (10YR 5/1), moist, fine to medium grained, subrounded (0/100/0), slight hydrocarbon odor.	10.0' Top Depth of Screen	HS = 35.2 ppm
	11.5	100	SPT-2				BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0
15	13.5						
	15.0	100	SPT-3		15-18.5' - Becomes wet.		HS = 50.0 ppm
20	18.5				Silt (SM) 18.75-26' - gray, (10YR 5/1), very moist, soft, low plasticity, slightly blocky, moderate hydrocarbon odor, moderate dark stain (0/5/95).		HS = 35.2 ppm
	20.0	100	SPT-4				BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0
	21.5	100	SPT-5				
	23.0	100	SPT-6				
	24.5	100	SPT-7				
25	26.0	100	SPT-8			25.0' Bottom Depth of Screen 25.5' Bottom Depth of Well and Filter Pack	HS = 32.8 ppm
					End Drilling on 6/12/2013 Total Borehole Depth: 26.0 ft bgs		
					ABBREVIATIONS ' = Feet BZ = Breathing Zone HS = Head Space Sample VOCs = Volatile Organic Compounds	Well Casing and Screen Materials Casing Material: Sch 40 PVC Casing Diameter: 2-in Seal Transition Type: Pea Gravel Seal Type: 3/8" Bentonite Chips Pack Type: 10 X 20 Colorado Sand Screen Length: 15 ft Screen Type: Sch 40 PVC, 0.010" Milled Slots	
30							
35							



PROJECT NUMBER:
475601.01.02

BORING NUMBER:
PZ-10

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Kinder Morgan Liquid Terminals Extraction Wells Installation

LOCATION : Linnton Terminal; Portland, OR

DRILLING CONTRACTOR : Cascade Drilling LP

DRILLING EQUIPMENT AND METHOD : CME-85 Truck-Mounted Drill Rig, Hollow Stem Auger

WATER LEVELS : ---

START : 6/11/2013

END : 6/12/2013

LOGGER : R. Lucich

WATER LEVELS		START DATE		END DATE		LOGGERS		
DEPTH BELOW SURFACE (feet)	SAMPLE INTERVAL (feet)		STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION		WELL CONSTRUCTION DIAGRAM	
	RECOVERY (%)	#TYPE	6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	CASING MATERIAL, SCREEN TYPE, SEAL TYPE, FILTER SAND TYPE	PID Reading (ppm):		
					10" Flush Mount Vault			
5					Well Graded Gravel (GW) 0.0-0.5' - gray, (2.5Y 5/1), dry, loose, angular	1.0' Top Depth of Seal Transition		
					Well Graded Sand (SW) 0.5-3.0' - brown, (10YR 4/3), moist, loose, fine to coarse grained, subrounded with rounded boulders to 10" (5/95/0).			
	5.0	100	SPT-1		Well Graded Sand (SW) 3.0-22.5' - dark brown, (10YR 3/3), moist, loose, fine to coarse grained, subrounded (0/95/5).	3.0' Top Depth of Seal	BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0	
	6.5							
10						11.0' Top Depth of Filter Pack		
	10.0	100	SPT-2				BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0	
	11.5							
15						13.0' Top Depth of Screen		
	15.0	100	SPT-3				BZ Oxygen = 20.9 LEL = 0 VOCs = 0.0	
	16.5				16.5-20.0' - Becomes wet.			
20								
	20.0	100	SPT-4		22' - Grades to medium grained, poorly graded sand, wet.			
	21.5							
	23.0	100	SPT-5		Silty Sand (SM) 22.5-23.25' - dark grayish brown, (10YR 4/2), wet, loose, fine grained (0/70/30).			
25						28.0' Bottom Depth of Screen		
	24.5	100	SPT-6		Clayey Sandy Silt (ML) 23.25-24.25' - dark gray, (10YR 4/1), wet, slightly stiff, (0/30/70).			
	26.0	100	SPT-7		Silt (SM) 24.25-28.0' - light olive brown, (2.5Y 5/3), moist, slightly stiff, low plasticity (0/0/100).			
	27.5	100	SPT-8		End Drilling on 6/11/2013 Total Borehole Depth: 28.0 ft bgs	28.5' Bottom Depth of Well and Filter Pack		
30								
35								
ABBREVIATIONS ' = Feet BZ = Breathing Zone VOCs = Volatile Organic Compounds					Well Casing and Screen Materials Casing Material: Sch 40 PVC Casing Diameter: 2-in Seal Transition Type: Pea Gravel Seal Type: 3/8" Bentonite Chips Pack Type: 10 X 20 Colorado Sand Screen Length: 15 ft Screen Type: Sch 40 PVC, 0.010" Milled Slots			



PROJECT NUMBER
497639.01.02

BORING NUMBER
EW-6

SHEET 1 OF 1

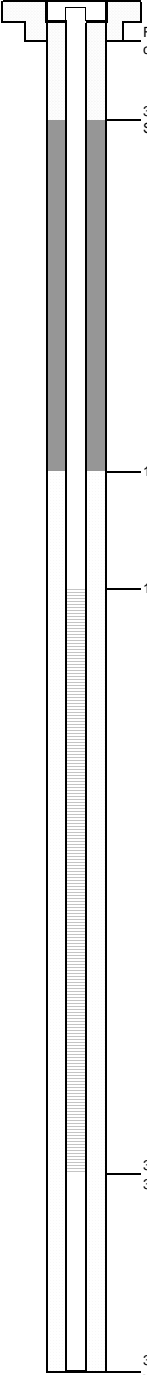
SOIL BORING LOG and WELL CONSTRUCTION

PROJECT : Kinder Morgan Linnton Terminals Extraction Wells Installation LOCATION : Portland, Oregon

DRILLING CONTRACTOR Cascade Drilling LP

DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Auger, CME-85 Truck-Mounted Rig (8.25"/12.25" AUGER)

WATER LEVELS :-- START : 8/28/2014 END : 8/28/2014 LOGGER : J. Sager

DEPTH BELOW SURFACE (FT)	STANDARD		CORE DESCRIPTION		WELL CONSTRUCTION DIAGRAM	
	SAMPLE INTERVAL (FT)	RECOVERY (FT)	#/TYPE	PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	CASING MATERIAL, SCREEN TYPE, SEAL TYPE, FILTER SAND TYPE
0	0.0		Air Knife		Air Knife to 5.0 ft bgs	 <p>Flush-mount vault and cement seal (to 3.0' bgs)</p> <p>3.0' to 12.0' Bentonite Chip Seal</p> <p>12.0' Top Depth of Filter Pack</p> <p>15.0' Top Depth of Screen</p> <p>30.0' Bottom of Screen</p> <p>30.0-35.0' - Sump</p> <p>35.0' Bottom Depth of Well</p> <p>12"</p> <p>BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H₂S = 0 ppm</p>
5	5.0	1.5/1.5	SPT-1		Silt (ML) 5.0-15.5' - dark brown (10YR 3/3), moist, medium stiff, non-plastic (0/0/100)	
	6.5					
10	10.0	1.5/1.5	SPT-2		10.0' - becomes medium plasticity	
	11.5					
15	15.0	1.0/1.5	SPT-3		Sand with Silt (SM) 15.5-21.0' - black (N 2.5/), moist, loose, fine to medium sand, strong odor (0/80/20)	
	16.5					
20	20.0	1.0/1.5	SPT-4		Silt (ML) 21.0-35.0' - greenish black (10 GY 2.5/1), medium soft, non-plastic, strong odor (0/0/100)	
	21.5					
25	25.0	1.5/1.5	SPT-5		25.0' - becomes medium plasticity, visible product	
	26.5	1.0/1.5	SPT-6			
	28.0	1.5/2.0	SPT-7			
30	30.0	2.0/2.0	SPT-8		30.0' - abundant oil mottled through sample	<p>BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H₂S = 0 ppm</p>
	32.0	1.5/1.5	SPT-9		31.5' - grades to very dark greyish brown (10 YR 3/2)	
	33.5	1.5/1.5	SPT-10			
35	35.0				End Drilling on 8/28/2014 Total Borehole Depth: 35.0 ft bgs	
					ABBREVIATIONS ' = Feet BZ = Breathing Zone VOCs = Volatile Organic Compounds	<p>Well Casing and Screen Materials Casing Material: Sch 40 PVC Casing Diameter: 4-in Seal Type: 3/8" Bentonite Chips Pack Type: 10x20 Colorado Sand Screen Length: 15 ft Screen Type: Sch 40, 0.020" Milled Slots</p>



PROJECT NUMBER
497639.01.02

BORING NUMBER
EW-7

SHEET 1 OF 1

SOIL BORING LOG and WELL CONSTRUCTION

PROJECT : Kinder Morgan Linnton Terminals Extraction Wells Installation LOCATION : Portland, Oregon

DRILLING CONTRACTOR Cascade Drilling LP

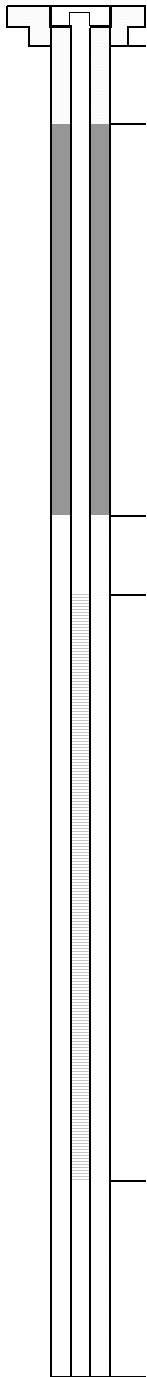
DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Auger, CME-85 Truck-Mounted Rig (8.25'/12.25" AUGER)

WATER LEVELS : --

START : 8/28/2014

END : 8/29/2014

LOGGER : J. Sager

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL (FT)		STANDARD PENETRATION TEST RESULTS 6"-6'-6"-6" (N)	CORE DESCRIPTION	WELL CONSTRUCTION DIAGRAM	
	RECOVERY (FT)	#/TYPE			CASING MATERIAL, SCREEN TYPE, SEAL TYPE, FILTER SAND TYPE	PID READING
0	0.0		Air Knife	Air Knife to 5.0 ft bgs on 8/28/2014	 <p>Flush-mount vault and cement seal (to 3.0' bgs)</p> <p>3.0' to 13.0' Bentonite Chip Seal</p> <p>13.0' Top Depth of Filter Pack</p> <p>15.0' Top Depth of Screen</p> <p>30.0' Bottom Depth of Screen</p> <p>30.0-35.0' - Sump</p> <p>35.0' Bottom Depth of Well</p> <p>12"</p> <p>Well Casing and Screen Materials Casing Material: Sch 80 PVC Casing Diameter: 4-in Seal Type: 3/8" Bentonite Chips Pack Type: 10x20 Colorado Sand Screen Length: 15 ft Screen Type: Sch 80, 0.020" Milled Slots</p>	
5	5.0	1.5/1.5	SPT-1	13-15-16	Silty Sand (SM) 5.0-25.5' - brown (10 YR 2/3), slightly moist, loose, fine to medium sand with <10% angular to subangular gravel 5.5' - grades to black (N 2.5/), strong hydrocarbon odor	HS VOCs = 2.63 ppm BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H ₂ S = 0 ppm
10	10.0	1.5/1.5	SPT-2	7-10-11	10.0-11.5' - strong hydrocarbon odor	HS VOCs = 165 ppm BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H ₂ S = 0 ppm
15	15.0	1.5/1.5	SPT-3	7-11-13	15.0-16.5' - strong hydrocarbon odor	HS VOCs = 312 ppm BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H ₂ S = 0 ppm
20	20.0	1.5/1.5	SPT-4	4-6-7	20.0-21.5' - strong hydrocarbon odor	HS VOCs = 143 ppm BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H ₂ S = 0 ppm
25	25.0	1.5/1.5	SPT-5	4-5-7	Silt (ML) 25.5-26.5' - brown (10 YR 4/3), soft	HS VOCs = 10.3 ppm
	26.5	1.5/1.5	SPT-6	4-6-8	26.5-27.0' - with interbedded silty sand (SM) 27.0-28.0' - medium stiff	HS VOCs = 88.0 ppm
	28.0	2.0/2.0	SPT-7	6-10-12-14	28.0' - interbedded with black (N 2.5/) stringers of silty sand (SM)	HS VOCs = 12.5 ppm
30	30.0	1.5/1.5	SPT-8	2-2-3	31.5' - interbedded with 1-2" stringers of brown silt	BZ Oxygen = 20.9% LEL = 0% VOCs = 0.0 ppm H ₂ S = 0 ppm
	31.5	1.5/1.5	SPT-9	1-2-4		HS VOCs = 2.90 ppm
	33.0	2.0/2.0	SPT-10	2-3-4-6		HS VOCs = 0.40 ppm
35	35.0			34.0' - interbedded with sand stringers 34.5-35.0' - grades to medium stiff		
				End Drilling on 8/29/2014 Total Borehole Depth: 35.0 ft bgs		
				Abbreviations: ' = Feet, BZ = Breathing Zone, HS = Head Space, VOCs = Volatile Organic Compounds		